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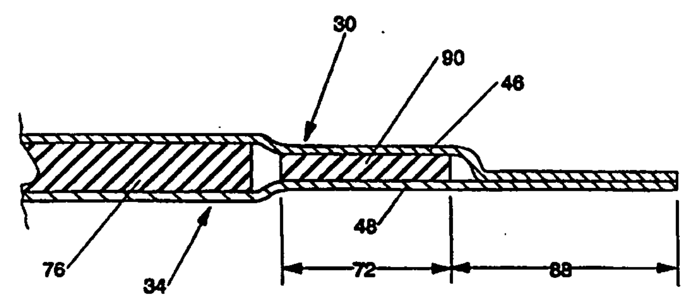

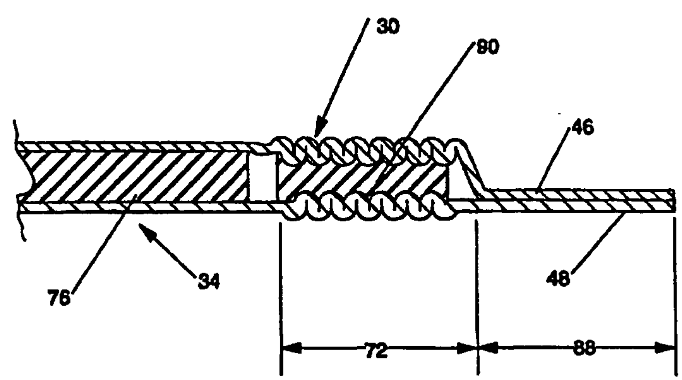

(57) Abstract

A fluid impervious "zero strain" stretch laminate web having a fluid impervious elastic member substantially continuously secured to a substantially untensioned nonwoven member. The nonwoven member is elongatable but exhibits less elastic recovery than said elastic member. The laminate web has an original unstretched length. The nonwoven member and the elastic member stretch but do not rupture when subjected to a mechanical stretching operation which stretches said laminate web to at least 50 % of its original unstretched length.

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FLUID IMPERVIOUS ZERO STRAIN STRETCH LAMINATE WEB

FIELD OF THE INVENTION

The present invention relates to a "zero strain" stretch laminate web which is assembled in a substantially untensioned (i.e., "zero strain") condition and which is capable of being rendered elastic by mechanical stretching, and more particularly relates to such a "zero strain" stretch laminate web which maintains its fluid impermeability even at relatively high levels of stretch.

BACKGROUND OF THE INVENTION

In simplest terms, a "zero strain" fluid impervious, stretch laminate web, as those terms are used herein, refers to a laminate web comprised of at least two plies of material which are secured to one another, substantially continuously, along at least a portion of their coextensive surfaces while in a substantially untensioned ("zero strain") condition. At least one of said plies is preferably in the form of a continuous web to facilitate continuous, high speed processing. The other of said plies may comprise a continuous web or discrete elements or patches secured to the continuous web at predetermined locations.

An "intermittently" bonded laminate web shall mean a laminate web wherein prior to the application of tension the plies are initially bonded to one another at discrete spaced apart areas. Conversely, a "substantially continuously" bonded laminate web shall mean a laminate web wherein prior to the application of tension the plies are initially bonded substantially continuously to one another throughout their areas of interface. Substantially continuously bonded laminate webs can be formed by extruding a first substantially continuous, thermoplastic adhesive ply directly onto a second ply while the first ply is in a heated condition, passing two heat bondable plies between a heated smooth surfaced roll nip or by applying a substantially continuous adhesive coating, spray or densely patterned melt blown to one of the plies prior to bringing it in contact with the other ply.

One of the plies employed in a "zero strain" fluid impervious stretch laminate

web of the present invention is comprised of a material which is fluid impervious stretchable, and elastomeric, i.e., it will return substantially to its untensioned dimensions after an applied elongation force has been released. The second ply secured to the elastomeric fluid impervious ply is elongatable, most preferably drawable, but is not necessarily elastomeric. Furthermore, the second ply is not necessarily fluid impervious. Whatever its composition, the second ply will, upon stretching, be at least to a degree permanently elongated so that upon release of the applied elongation forces, it will not fully return to its original undistorted configuration. However, it is important in the stretching operation that the second ply maintain its continuity and not fail either through fiber/fiber disentanglement or fiber breakage. To the extent that the permanently elongated second ply is not secured to the elastomeric fluid impervious web after the stretching operation, the permanently elongated second ply expands in the z-direction between its points of securement to the elastomeric fluid impervious web when the elastomeric fluid impervious web to which it is secured returns to its substantially undistorted configuration in the x-y plane. The greater the distance between the adjacent points of securement in the x-y plane after stretching, the greater will be the degree of z-direction expansion in the resultant laminate web. Regardless of the degree of z-direction expansion, the resultant "zero strain" stretch laminate web is thereafter elastically extensible in the direction of initial stretching, at least up to the point of initial stretching.

U.S. Pat. No. 4,834,741 issued to Sabee on May 30, 1989 and hereby incorporated herein by reference, discloses a single use garment, such as a disposable diaper, employing a "zero strain" stretch laminate material comprising an untensioned elastomeric element secured between a pair of drawable elements in its opposed waistband and legband portions. The elastic elements 41 shown in FIG. 1 of Sabee are affixed in the waistband portions of the diaper web while in a substantially relaxed condition to a drawable topsheet web, a drawable backsheet web or both. The bonding configuration employed by Sabee may be either intermittent, as by passing the laminate material through a pressure nip formed between two rolls, one of which is heated and contains a plurality of raised points on its surface, or continuous, as by depositing a thin band of viscoelastic hot melt pressure sensitive adhesive onto one of the webs and thereafter pressing the hot melt pressure sensitive adhesive to the other web by passing the laminate through a pressure nip formed between a pair of smooth surfaced rolls.

Regardless of which bonding configuration is employed, the portions of the diaper web containing elastic web elements 41 are thereafter laterally stretched in the

cross-machine direction by the meshing corrugations on pairs of corrugated rolls 31, as generally shown in Sabee's FIGS. 5 and 6. Simultaneously the coinciding portions of the drawable topsheet and backsheet webs in the area of elastic element attachment are incrementally stretched and drawn to impart a permanent elongation and molecular orientation to the fibers in the cross-machine direction. Because corrugated rolls 31 have their meshing corrugations aligned substantially parallel to the machine direction, incremental stretching of the web takes place in the cross-machine direction. Accordingly, the fully processed waistband portions of Sabee's diaper web are thereafter elastically extensible in the cross-machine direction, at least up to the point of initial stretching.

A similar machine direction stretching operation is preferably carried out with respect to the opposed legbands, which include untensioned elastic elements 42, by passing the diaper web of Sabee between another pair of meshing corrugated rolls 89, as generally shown in FIGS. 12 and 13. Because corrugated rolls 89 have their meshing corrugations aligned substantially parallel to the cross-machine direction, incremental stretching of the web takes place in the machine direction. Accordingly, the legband portions of Sabee's diaper web are thereafter elastically extensible in the machine direction, at least to the point of initial stretching.

While Sabee's suggestion to use corrugated rolls to stretch a "zero strain" stretch laminate web has been found to work reasonably well when the desired degree of stretching, and hence extensibility, is relatively small, and the fluid impervious property of the elastic laminate is noncritical, the present Applicant has discovered that for higher degrees of stretching there is a tendency for the corrugated rolls to cause damage to the web when traditional topsheet materials are used. In the high degree ranges of stretch, this damage typically takes the form of rupturing one or more of the webs comprising the "zero strain" stretch laminate in the pattern of the corrugations. Such damage can render the resultant "zero strain" stretch laminate web unsuitable for serving as a stretchable, fluid impervious material on an absorbent article.

The aforementioned problems become more and more pronounced as the speed of the web processing and the desired degree of stretching increase and the elongation to rupture characteristic of the stretch laminate web in question decreases.

U.S. Pat. No. 5,143,679 issued to Weber, et al. on September 1, 1992, discloses a way to eliminate or at least reduce the severity of the foregoing problem in many of the "zero strain" stretch laminate webs which exhibit this behavior. Weber, et al. discloses a method and apparatus for sequentially stretching the "zero strain" stretch

laminate portions of the web during the incremental stretching process. In a particularly preferred embodiment, the mechanical stretching operation is carried out in stages by passing the laminate web between multiple pairs of meshing corrugated rolls, each pair of rolls exhibiting a greater degree of meshing than the preceding pair, to sequentially stretch the web while minimizing damage thereto. The use of multiple roll pairs with progressively greater degrees of meshing imposes a lower strain rate on the web than would be the case for a single pair of meshing corrugated rolls having an amplitude and degree of meshing comparable to the final pair of multiple rolls. In addition, the temporary release of tension from the web as it passes between the successive roll pairs allows some degree of stress redistribution to occur in the web prior to the web's being incrementally stretched to a greater degree by each succeeding roll pair. Minimizing the strain rate and allowing a degree of stress redistribution in the foregoing manner minimizes the tendency to cause damage to the web.

SUMMARY OF THE INVENTION

The present invention pertains to a fluid impervious "zero strain" stretch laminate web. The laminate web has an original unstretched length. The web includes a fluid impervious elastic member substantially continuously secured to at least one substantially untensioned nonwoven member which is elongatable, but which exhibits less elastic recovery than said elastic member. The nonwoven member and the elastic member stretch but do not rupture when subjected to a mechanical stretching operation which stretches said laminate to at least 50% of its original unstretched length. In a preferred embodiment, the nonwoven member and the elastic member stretch but do not rupture when subjected to a mechanical stretching operation which stretches said laminate to at least 100% of its original unstretched length. In a particularly preferred embodiment, the nonwoven member and the elastic member stretch but do not rupture when subjected to a mechanical stretching operation which stretches said laminate to at least 200% of its original unstretched length.

Preferably, the nonwoven member is comprised of spunbonded polyethylene fibers.

The laminate web of the present invention may be used to form a portion of a disposable diaper or a training pant. Preferably, the laminate web forms an ear flap or an elasticized waistband on a disposable diaper or a training pant.

BRIEF DESCRIPTION OF THE DRAWINGS

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter which is regarded as forming the present invention, it is believed that the invention will be better understood from the following description which is taken in conjunction with the accompanying drawings in which like designations are used to designate substantially identical elements, and in which:

FIG. 1 is a perspective view of a disposable training pant embodiment of the present invention in a typical in-use configuration as it would be applied to a wearer;

FIG. 2 is a plan view of the chassis of the training pant embodiment of the present invention having portions cut away to reveal the underlying structure, the surface which will form the outer surface of the disposable garment facing away from the viewer;

FIG. 3 is a fragmentary sectional view of the chassis shown in FIG. 2 taken along section line 3-3 of FIG. 2, prior to subjecting the ear flap to mechanical stretching;

FIG. 3A is a fragmentary sectional view of the chassis shown in FIG. 2 taken along section line 3-3 of FIG. 2, after subjecting the ear flap to mechanical stretching and being allowed to return to its substantially untensioned condition;

FIG. 4 is a simplified perspective view of an apparatus that employs a vacuum web restraint system for mechanically stretching a portion of a chassis web using meshing corrugated rolls;

FIG. 4A is a simplified view taken along line 4A-4A in FIG. 4 showing the manner in which idler rolls are used to cause the chassis web to wrap the lower most corrugated rolls;

FIG. 4B is a highly enlarged view taken at the inset 4B shown in FIG. 4 showing the degree of meshing of the corrugated rolls with one another as the "zero strain" stretch laminate portion of the chassis web passes there between;

FIG. 4C is a greatly enlarged view of a segment of the "zero strain" stretch laminate web of the present invention as it passes between the lowermost and uppermost corrugated rolls;

FIG. 4D is a greatly enlarged view of a segment of a prior art "zero strain" stretch laminate web as it passes between the lowermost and uppermost corrugated rolls;

FIG. 5 is a simplified perspective view showing an alternative web restraint

system of the present invention which may be used during the incremental stretching process disclosed herein;

FIG. 5A is a highly enlarged simplified cross-sectional view taken at inset 5A shown in FIG. 5 along a centerline connection the uppermost corrugated rolls and the lower most corrugated rolls;

FIG. 6 is a side elevational schematic view of one ultrasonic apparatus which may be used to produce the seams of the present invention; and

FIG. 6A is a fragmentary sectional view of the apparatus shown in FIG. 6 taken along section line 6A-6A of FIG. 6.

DETAILED DESCRIPTION OF THE INVENTION

It will be readily apparent to those skilled in the art that although the following description of the present invention is in connection with a single use training pant or diaper structure having preselected fluid impervious, elasticized portions, e.g., ear flaps, the present invention may be practiced with equal facility on nearly any web comprised entirely of or containing discrete, isolated "zero strain" stretch laminate portions.

A unitary disposable garment is one which is intended to be discarded after it is used (i.e., it is not intended to be laundered or otherwise restored or reused), and which does not require separately manipulative parts such as a separate chassis and separate ear flaps. The disposable garment may be provided with an absorbent assembly which is placed in close proximity to the body of the wearer to absorb and contain the various exudates discharged from the body. A preferred embodiment of the unitary disposable garment of the present invention, disposable training pants 20, is shown in FIG. 1. The training pants 20 of FIG. 1, comprise a chassis 14, side seams 10, and an absorbent assembly 22.

FIG. 2 is a partially cut-away plan view of the disposable training pants 20 of FIG. 1, prior to the front portion 56 and the rear portion 58 of the chassis 14 being joined together by the seams 10. The chassis 14 of the present invention preferably has a symmetric, modified hour-glass shape. The chassis 14 will have at least a front portion 56, a rear portion 58, a crotch portion 57, longitudinal side regions 88, and ear flaps 72 and will comprise an elastic ear flap member 90 operatively associated with each ear flap 72 to form a laminated ear flap which will be elastically activated by a mechanical stretching process which will be described in greater detail herein below. The absorbent assembly 22 is secured to the chassis 14.

As shown in FIG. 2, a preferred embodiment of the chassis 14 further

comprises an outer layer 48 and an inner layer 46 with the elastic ear flap members 90, elastic waistband members 76, and elastic strands 105 preferably secured between the inner layer 46 and outer layer 48.

The outer layer 48 is that portion of the chassis 14 which will form the exterior of the disposable training pants 20, i.e. face away from the wearer. The outer layer 48 is compliant, soft feeling, and non-irritating to the wearer's skin. A suitable outer layer may be manufactured from a wide range of materials, such as plastic films; woven or nonwoven webs of natural fibers (e.g. wood or cotton fibers), synthetic fibers (e.g. polyolefins, polyamides, polyester, polypropylene, or polyethylene fibers), or a combination of natural and synthetic fibers; or coated woven or nonwovens. Preferably, the outer layer 48 is a spunbonded web of polyethylene fibers available as #86964-S manufactured by Polybond Co. of Waynesboro, Virginia or a spunbonded web of polyethylene fibers available as Corolind 16714 from Corovin of Peine, Germany.

The inner layer 46 is that portion of the chassis 14 which will form the interior of the chassis 14, and will contact at least the waist and legs of the wearer. The inner layer is also compliant, soft feeling, and non-irritating to the wearer's skin. A suitable inner layer 46 may be manufactured from a wide range of materials, such as plastic films; woven or nonwoven webs of natural fibers (e.g. wood or cotton fibers), synthetic fibers (e.g. polyolefins, polyamides, polyester, polypropylene, or polyethylene fibers), or a combination of natural and synthetic fibers; or coated woven or nonwoven webs. Preferably, the inner layer 46 is made of the same material as the outer layer 48. A suitable inner layer is a spunbonded web of polyethylene fibers available as #86964-S manufactured by Polybond Co. of Waynesboro, Virginia or a spunbonded web of polyethylene fibers available as Corolind 16714 from Corovin of Peine, Germany.

The inner layer 46 is preferably positioned adjacent to the outer layer 48 and is preferably joined thereto by attachment means (not shown) such as those well known in the art. For example, the inner layer 46 may be secured to the outer layer 48 by a uniform continuous layer of adhesive, a patterned layer of adhesive, or an array of separate lines, spirals, or spots of adhesive. Adhesives which have been found to be satisfactory are manufactured by Findley Adhesives of Elm Grove, Wisconsin and marketed as Findley 2031. Alternatively, the attachment means may comprise heat bonds, pressure bonds, ultrasonic bonds, dynamic mechanical bonds, or any other suitable attachment means or combinations of these attachment means as are known

in the art. As used herein, the term "joined" encompasses configurations whereby an element is directly secured to the other element by affixing the element directly to the other element, and configurations whereby the element is indirectly secured to the other element by affixing the element to intermediate member(s) which in turn are affixed to the other element. In a preferred embodiment of the present invention, the inner layer 46 and the outer layer 48 are indirectly joined together by directly joining them to the elastic ear flap members 90, elastic waistband members 76, and elastic strands 105 and are joined directly to each other in the areas extending beyond the elastic ear flap members 90, elastic waistband members 76, and elastic strands 105.

In a preferred embodiment of the present invention, at least a portion of the chassis inner and outer layers 46, 48 will be subjected to mechanical stretching in order to provide a "zero strain" stretch laminate that forms the elasticized ear flaps 30. Thus, the inner and outer layers 46, 48 are preferably elongatable, most preferably drawable, but not necessarily elastomeric, so that the inner and outer layers 46, 48 will, upon mechanical stretching, be at least to a degree permanently elongated such that they will not fully return to their original undistorted configuration. In preferred embodiments, the inner and outer layers 46, 48 can be subjected to mechanical stretching without undue rupturing or tearing.

In a preferred embodiment, the chassis 14 comprises elasticized ear flaps 30 in the front portion 56 and the rear portion 58. The elasticized ear flaps 30 are unitary elements of the chassis, i.e. they are not separately manipulative elements secured to the chassis, but rather are formed from and are extensions of the chassis materials. The elasticized ear flaps 30 provide an elastically extensible feature that provides a more comfortable and contouring fit by initially conformably fitting the disposable garment to the wearer and sustaining this fit throughout the time of wear well past when the disposable garment has been loaded with exudates since the elasticized ear flaps allow the sides of the disposable garment to expand and contract.

As shown in FIG. 2, each ear flap 72 comprises that portion of the chassis 14 that extends laterally outwardly from and along the central region 68 of the chassis 14 to the longitudinal side region 88 of the chassis 14. The ear flap 72 generally extends longitudinally from the end edge 64 of the chassis 14 to the portions of the longitudinal edge 62 of the chassis 14 that forms the leg opening (this segment of the longitudinal edge 62 being designated as leg edge 106). In a preferred embodiment of the present invention, each ear flap is formed by the portions of the inner layer 46 and the outer layer 48 that extend beyond the central region 68 of the chassis 14.

In a preferred embodiment of the present invention, the elastic ear flap members 90 are operatively associated with the chassis 14 in the ear flaps 72, preferably between the inner layer 46 and the outer layer 48, so that the elastic ear flap members 90 allow the elasticized ear flaps 30 to be elastically extensible in the lateral direction (laterally elastically extensible). As used herein, the term "elastically extensible" means a segment or portion of the chassis that will elongate in at least one direction (preferably the lateral direction for the ear flaps and the waistbands) when tensional forces (typically lateral tensional forces for the ear flaps and the waistbands) are applied, and will return to about its previous size and configuration when the tensional forces are removed. Generally, elastomeric materials useful in the present invention will contractively return to at least about 75% of their original configuration within about 5 seconds or less upon stretch and immediate release thereof (i.e., a "snappy" elastic).

In an especially preferred embodiment shown in FIG. 3, the elastic ear flap member 90 is operatively associated in the ear flap 72 by joining the elastic ear flap member 90 to both the inner layer 46 and the outer layer 48 while the elastic ear flap member 90 is in a substantially untensioned condition. The composite elastomeric laminate containing the elastic ear flap member 90 is shown in FIG. 3 prior to being subjected to mechanical stretching.

At least a portion of the resultant composite elastomeric laminate containing the elastic ear flap member 90 is then subjected to mechanical stretching sufficient to permanently elongate the inner layer and the outer layer components (nonelastic components) of the laminate. Referring now to FIG. 3A, the composite elastomeric laminate is shown after being subjected to mechanical stretching and having been allowed to return to its substantially untensioned condition. The elasticized ear flap is thus formed into a "zero strain" stretch laminate. The "zero strain" stretch laminate comprises a first ply of a material which is stretchable and elastomeric (i.e., it will return substantially to its untensioned dimensions after an applied tensile force has been released) and a second ply which is elongatable (but not necessarily elastomeric) so that upon stretching the second ply will be, at least to a degree, permanently elongated so that upon release of the applied tensile forces, it will not fully return to its original undeformed configuration. The resulting "zero strain" stretch laminate is thereby rendered elastically extensible, at least up to the point of initial stretching, in the direction of initial stretching.

In a preferred embodiment of the present invention, the elastic ear flap member

90 is substantially continuously bonded to both the inner layer 46 and the outer layer 48 using an adhesive. Alternatively, the elastic ear flap members 90 may be substantially continuously bonded to only the inner layer 46 or only the outer layer 48. A glue applicator may be used to apply a substantially uniform and continuous layer of adhesive to the outer layer 48 and/or the inner layer 46 in those predetermined areas where the substantially untensioned elastic ear flap member 90 will be placed. In a particularly preferred embodiment, the adhesive selected is stretchable and the glue applicator comprises a melt blown applicating system.

One such melt blown adhesive applicating system which has been found to be particularly well suited for producing a substantially continuously bonded "zero strain" stretch laminate web is a melt blown spray applicator Model No. GM-50-2-1-GH, as available from J&M Laboratories of Gainesville, Georgia. The latter system employs a nozzle having 20 orifices per lineal inch, as measured in the cross-machine direction, each orifice measuring approximately 0.020 inches in diameter. A Findley H-2247 Hot Melt Adhesive, as available from Findley Adhesives of Elm Grove, Wisconsin is preferably heated to a temperature of approximately 340°F and applied to the inner layer and/or the outer layer at a rate of approximately 7.5-10 milligrams per square inch. Heated compressed air at a temperature of approximately 425°F and a pressure of approximately 50 psig is issued through the secondary orifices in the adhesive nozzle to assist in uniformly distributing the adhesive fibrils during the laydown operation.

Alternatively, the elastic ear flap member 90 and any other components comprising the "zero strain" portions of the disposable training pants 20 may be bonded to one another using unheated adhesive, heat bonding, pressure bonding, ultrasonic bonding, dynamic mechanical bonding, or any other method as is known in the art.

The elastic ear flap members 90 may take on a number of different sizes, shapes, configurations and materials. One elastomeric material which has been found to be especially suitable for use as the elastic ear flap member 90 (especially for "zero strain" stretch laminates) is a Kraton film available from Clopay, of Cincinnati, Ohio as PA18-2514. Other suitable elastomeric materials for use as the elastic ear flap members 90 include "live" synthetic or natural rubber, other synthetic or natural rubber foams, elastomeric films (including heat shrinkable elastomeric films), fluid impervious elastomeric woven or nonwoven webs, elastomeric composites, or the like.

As shown in FIG. 1, the elastic ear flap member 90 comprises a patch of elastomeric material (elastomeric patch) that preferably extends through the entire length of the ear flap 72 in the front and rear portions 56, 58. Thus, the elastic ear flap member 90 preferably extends from the end edge 64 of the chassis 14 inward to the leg edge 106 of the ear flap 72. The length and width of the elastic ear flap members 90 are dictated by the disposable garment's functional design. Thus, while the elastic ear flap member 90 preferably extends through the entire length of the ear flap 72, the elastic ear flap member 90 may extend through only a portion of the length of the ear flap 72.

It has been found that the extension characteristics including the extension forces, extension modulus, and available stretch (extension); and the contractive forces; elastic creep; elastic hysteresis; and rate of contraction of the elasticized ear flaps 30 are important considerations in the performance of both the elasticized ear flaps 30 and the disposable garment. The extension characteristics give the wearer the overall perceived "stretchiness" during use. An elasticized ear flap with a relatively high extension modulus can cause red marking on the wearer's skin while a relatively low extension modulus can cause sagging/slipping on the wearer. Elasticized ear flaps having too little available stretch may not achieve a suitable level of body conformity and may contribute in making the disposable garment uncomfortable to wear and hard to apply. A disposable garment having elasticized ear flaps with very low contractive forces, or poor elastic creep or elastic hysteresis may not stay in place on the wearer and may tend to sag/slip on the wearer resulting in poor fit and containment.

Available stretch measures the maximum amount of material available in the elasticized ear flaps to reversibly stretch to conform to the wearer's body during wear. Thus, the amount of available stretch relates to the maximum amount of extension that is available to fit the garment to the wearer; in addition, the maximum amount of recoverable extension available for the garment to comply with wearer's body. The available stretch is calculated from the equation: ((maximum circumference of garment - circumference of wearer) ÷ circumference of wearer) x 100. The minimum amount of available stretch required for a disposable garment application using elasticized ear flaps, is preferably an available stretch of at least about 50% for a "one-size-fits-all" garment which will fit children from about 22 pounds to about 38 pounds. Higher levels of available stretch will provide an even greater fit range.

The amount of sustainable contractive force (tension) exerted by the elasticized ear flap on the wearer is an important property of the elasticized ear flap. An elasticized ear flap with insufficient contractive forces may result in the training pant slipping down after being worn and loaded. In contrast, excessive contractive forces may reduce the comfort for the wearer and produce pressure markings on the wearer's skin.

Particularly preferred methods and apparatus used for making "zero strain" stretch laminates out of the inner layer, outer layer, and an elastomeric member positioned between the same, use meshing corrugated rolls to mechanically stretch the components. A discussion of suitable apparatus and methods for mechanically stretching portions of a diaper is contained in U.S. Pat. No. 4,107,364 issued to Sisson on August 15, 1978 and U.S. Pat. No. 4,834,741 issued to Sabee on May 30, 1989. Each of these patents are incorporated herein by reference. Particularly preferred apparatus and methods are disclosed in commonly assigned, U.S. Pat. No. 5,167,897 issued to Weber et al. on December 1, 1992; U.S. Pat. No. 5,156,793 issued to Buell et al. on October 20, 1990; and U.S. Pat. No. 5,143,679 issued to Weber et al. on September 1, 1992; each of which are incorporated herein by reference.

Details of a particularly preferred incremental stretching system which can be employed in making "zero strain" stretch laminate elasticized ear flaps of the present invention are set forth in FIG. 4. The fully assembled chassis web 410 including the "zero strain" ear flap web is directed through the incremental stretching system.

Referring to FIG. 4, the timing of the chassis web 410 containing the substantially untensioned elastic ear flap members (elastomeric patches 404) is such that the substantially untensioned elastomeric patches 404 substantially coincide with the corrugated or grooved segments 424 contained on the uppermost corrugated rolls 425 as the chassis web 410 passes between the segments 424 of the uppermost corrugated rolls 425 and the continuously corrugated or grooved lowermost corrugated rolls 421.

While the exact configuration, spacing and depth of the complementary grooves on the uppermost and lowermost corrugated rolls will vary, depending upon such factors as the amount of elasticity desired in the "zero strain" stretch laminate portion, a peak-to-peak groove pitch of approximately 0.150 inches, an included angle of approximately 12 degrees as measured at the peak, and a peak-to-valley groove depth of approximately 0.300 inches have been employed in a particularly

preferred embodiment of the present invention. The exterior peak of each corrugation on the aforementioned corrugated rolls typically exhibits a radius of approximately 0.010 inches, while the internal groove formed between adjacent corrugations typically exhibits a radius of approximately 0.040 inches. When the corrugated rolls are adjusted so that their opposing peaks overlap one another to a depth between about 0.150 and about 0.175 inches, good elastic characteristics have been produced in a laminate web of the present invention comprised of 2.2 mil thick Kraton film patches substantially continuously bonded on their opposed surfaces to a spunbonded nonwoven inner layer and a spunbonded nonwoven outer layer having basis weights in the range of about 20 to 30 grams per square yard and comprised of polyethylene fibers, available as style #86964-S from Polybond Co. of Waynesboro, Virginia.

The degree of overlap of the opposing peaks on the aforementioned corrugated rolls may of course be adjusted, as desired, to produce more or less extensibility in the resultant "zero strain" stretch laminate web. For the aforementioned roll geometry and laminate web construction, peak-to-peak overlap depths ranging from as little as about 0.050 inches to as much as about 0.225 inches are feasible.

As can be seen from FIG. 4A, the chassis web 410 is caused by the idler rolls 472, 474 to wrap the lowermost corrugated rolls 421 sufficiently to cover the active vacuum ports 422 (shown in FIG. 4) located immediately adjacent each continuous set of grooves 423 on the lowermost rolls 421. The vacuum ports 422, which are positioned so as to substantially coincide with the grooved segments 424 on the uppermost corrugated rolls 425, are internally connected through the rolls 421 to a pair of vacuum manifolds 426 which exert suction against the chassis web 410 as the chassis web is acted upon by the grooved segments 424 of the uppermost corrugated rolls 425.

To minimize the build up of either the adhesive used to secure the untensioned elastomeric patches 404 to the inner layer web 405 and the outer layer web 406 or the adhesive used to secure the coinciding portions of the inner layer web and the outer layer web to one another, the grooved segments 424 on the uppermost rolls 425 and the continuous grooves 423 on the lowermost rolls 421 may be either comprised of a low friction material, such as TEFLON, or coated with a self-lubricating low friction material such as Permalon No. 503 spray coating, as available from Micro Surface Corporation of Morris, Illinois.

The vacuum ports 422 on the lowermost rolls 421 are preferably covered by a

porous material, such as 0.090 inch mesh honeycomb 444, to provide support to the portions of the chassis web 410 acted upon by the vacuum and to provide a good gripping surface against the web so as to substantially prevent lateral slippage or movement of the web across the honeycomb surface whenever the web is acted upon by the vacuum.

Under optimum circumstances, the maximum degree of incremental stretching which can be imparted to the "zero strain" portions of the ear flap containing the elastomeric patches 404 is determined by the depth of engagement between the grooves on segments 424 of the uppermost corrugated rolls 425 and the continuous grooves 423 on the lowermost corrugated rolls 421. However, it has been discovered that unless the stretch laminate web is substantially prevented from slipping or contracting in a direction substantially parallel to the direction of web stretching as it passes between the meshing corrugated rolls, the optimum degree of incremental stretching is not realized. Therefore, in its most preferred form, the incremental web stretching operation is carried out while the outermost portions of all three layers comprising the "zero strain" stretch laminate are subjected to restraint, as generally shown in the cross-section of FIG. 4B, to substantially prevent the "zero strain" stretch laminate portions of the chassis web from slipping or contracting in a direction parallel to the desired direction of stretching as it passes between the sets of sequentially positioned meshing corrugated rolls.

However, the present invention may also, if desired, be practiced to advantage by restraining only the elongatable or drawable layer or layers of the composite, i.e., it is not an absolute requirement that the outermost portions of the elastomeric patches also be restrained during the incremental stretching operation. In the latter instance, the elongatable or drawable layer or layers are still permanently elongated during the incremental stretching process, but the z-direction bulking in the resultant "zero strain" stretch laminate web may be somewhat less pronounced when the stretching tension is removed. This is due to the fact that the elastomeric patch undergoes a lesser degree of initial stretching during such a process. Accordingly, it can only undergo this same amount of retraction when it returns to its undistorted configuration.

The suction forces applied to the chassis web 410 shown in FIGS. 4-4B by the vacuum ports 422 acting through the porous honeycomb material 444 substantially prevent those portions of the chassis web 410 containing the substantially untensioned elastomeric patches 404 from slipping or contracting in a laterally inward

direction as they pass between the meshing portions of the continuous grooves 423 on the lowermost corrugated rolls 421 and the grooved segments 424 on the uppermost corrugated rolls 425.

Because the "zero strain" stretch laminate portions of the chassis web 410 containing the elastomeric patches 404 are laterally restrained throughout the web stretching operation, all portions of the "zero strain" stretch laminate web located intermediate the points of restraint are subject to substantially uniform incremental stretching as the web passes between the continuous grooves 423 on the lowermost corrugated rolls 421 and the meshing portions of the grooved segments 424 on the uppermost corrugated rolls 425.

This not only maximizes the effectiveness of the incremental web stretching operation by forcing the elongatable inner cover and outer cover webs secured to the elastomeric patches to undergo the fullest possible degree of elongation during the stretching operation, but also substantially prevents disproportionately high straining of the inner layer and/or outer layer webs to which they are secured in the areas immediately adjacent the opposed peripheral edge portions of the elastomeric patches.

Referring now to FIG. 4C there is shown a greatly enlarged segment of the chassis web 410 as it passes between the meshing portions of the continuous grooves 423 on the lowermost corrugated rolls 421 and the grooved segments 424 on the uppermost corrugated rolls 425. As the web 410 is stretched between the continuous grooves 423 on the lowermost corrugated rolls 421 and the grooved segments 424 on the uppermost corrugated rolls 425, both the inner layer web 405 and the outer layer web 406 elongate substantially uniformly without allowing any localized straining to take place in elastomeric patch 404 sufficient enough to cause the elastomeric patch 404 to rupture. By maintaining the integrity of the elastomeric patch 404, i.e., not rupturing the elastomeric patch 404, the fluid impervious property of the laminate web 410 is maintained. Upon relaxation of the web 410, both the elastomeric patches 404 and the inner and outer layer web 405, 406, are intact and now capable of being stretched to the limits of elongation previously experienced in the mechanical stretching operation. The stretching limit of the mechanical stretching operation is preferably at least about 50% more than the web's original unstretched dimension, more preferably is at least about 100% more than the web's original unstretched dimension, and most preferably is at least about 200% more than the web's original unstretched dimension.

Referring now to FIG. 4D there is shown a greatly enlarged segment of a prior art "zero strain" stretch laminate web 480 as it passes between the meshing portions of the continuous grooves 423 on the lowermost corrugated rolls 421 and the grooved segments 424 on the uppermost corrugated rolls 425. The web 480 is comprised of a fluid impervious elastomeric member 482 substantially continuously bonded to a pair of nonwoven webs 483, 484. As the web 480 is stretched between the continuous grooves 423 on the lowermost corrugated rolls 421 and the grooved segments 424 on the uppermost corrugated rolls 425 the nonwoven webs 483, 484 begin to elongate nonuniformly in the region generally designated as 486. The nonuniform elongation of the nonwoven webs 483, 484 may be attributed to the bond strength of the nonwoven webs or the drawability of the individual fibers of the nonwoven webs. As the nonwoven webs nonuniformly elongate in region 486 a localized strain is placed on the elastomeric member 482 within region 486.

Additional stretching of the web 480 causes the elastomeric member 482 to rupture in region 486 thereby destroying the fluid impervious property of the elastomeric member 482 and hence the laminate web 480. The rupturing of elastic member 482 is believed to be caused by the concentration of strain occurring in region 486 which exceeds the strain limits of the elastomeric member 482. This rupturing of the prior art "zero strain" stretch laminate web 480 renders the web unacceptable for some executions, e.g., rupturing of the fluid impervious elastomeric member 482 destroys the laminate webs 480 ability to provide a fluid impervious barrier. Furthermore, rupturing of the laminate web may create an aesthetically unpleasant appearance to the user. The "zero strain" stretch laminate webs of the prior art can be stretched about 35% of their original unstretched length without rupturing the elastomeric component. However, the fluid impervious "zero strain" stretch laminate webs of the prior art rupture when incrementally stretched beyond 35% of their original unstretched length. Therefore, the prior art "zero strain" stretch laminate webs are unacceptable for use in executions requiring at least 50% extension while maintaining their fluid impervious property.

While the fluid impervious "zero strain" stretch laminate web of the present invention has been described as a laminate comprised of an elastomeric member substantially continuously secured to two nonwoven members, the web may also comprise one nonwoven web member substantially continuously secured to a fluid impervious elastomeric member. The nonwoven web will uniformly elongate without allowing any localized straining to occur in the elastomeric member sufficient enough

to cause rupturing of the elastomeric member. Additional members may be secured to the other surface of the fluid impervious elastomeric member, including but not limited to nonwovens, coated nonwovens, films and formed films.

FIG. 5 discloses an alternative incremental web stretching system which can be employed. In the incremental web stretching system shown in FIG. 5, a pair of resiliently compressible disks 540 are mounted adjacent each side of the grooved segments 524 of the uppermost corrugated rolls 525. The compressible disks 540 are of a large enough diameter that they tightly grip the chassis web 510 and hold it securely against the coinciding non-grooved portions of the lowermost corrugated rolls 521 as generally shown in the cross-section of FIG. 5A. Like the vacuum ports and the porous honeycomb material in the embodiment of FIG. 4, the clamping effect created by the compressible disks 540 and the coinciding non-grooved portions of the lowermost rolls 521 substantially prevents the portion of the chassis web 510 containing the elastomeric patches 504 from contracting in a direction parallel to the direction of stretching as the web passes between the meshing corrugated rolls.

As will be appreciated by those skilled in the art, the foregoing restraint methods may be employed either individually or in combination with one another to produce the benefits herein described in the resultant "zero strain" stretch laminate portions of the resultant chassis web.

From the description contained herein, it is clear that the method and apparatus may be employed to advantage to produce a wide range of disposable garments either comprised entirely of or including one or more discrete, isolated fluid impervious "zero strain" stretch laminate web portions of the present invention.

It is also recognized that while a pair of meshing corrugated rolls having their corrugations aligned substantially parallel to one another are disclosed in the accompanying drawings, the present invention may be practiced with equal facility employing pairs of corrugated rolls wherein the corrugations are not all oriented parallel to one another. Furthermore, the corrugations on such pairs of corrugated rolls need not necessarily be aligned parallel to either the machine or the cross-machine direction. For example, if a curvilinear waistband or legband portion is desired in a disposable garment constructed using the "zero strain" stretch laminate technology herein disclosed, the meshing teeth on the pairs of corrugated rolls employed to incrementally stretch the "zero strain" laminate web portions of the chassis web may be arrayed in the desired curvilinear configuration to produce elasticity along the desired curvilinear contour rather than in a straight line.

It is further recognized that while the preferred processes herein disclosed employ meshing cylindrical corrugated rolls, the web restraint principles may also be carried out utilizing an intermittent stamping operation employing meshing platens to incrementally stretch the "zero strain" stretch laminate portions of the web or article in question. In the latter instance, the only requirement is that the portions of the "zero strain" stretch laminate web to be incrementally stretched be adequately restrained by suitable vacuum or clamping means before the meshing platens are able to exert enough force on the web to cause slippage or contraction in a direction parallel to the direction of stretching.

The elasticized ear flaps 30 may also be provided with differential extensibility along the longitudinal axis when stretched in the lateral direction. As used herein, the term "differential extensibility" is used to mean a material having a nonuniform degree of elastic extensional properties, as measured in the direction of stretching at various points along an axis oriented substantially perpendicular to the direction of stretching. This may, for example, include varying the elastic modulus or available stretch or both of the elastomeric material(s). The differential extensibility is preferably designed into the elasticized ear flaps 30 so that the lateral extensibility varies longitudinally through at least a portion of the elasticized ear flap as measured from the end edge 64 of the disposable training pants 20 to the leg edge 106 of the ear flap. Without wishing to be bound by any theory, it is believed that differential extensibility along the longitudinal axis when stretched in the lateral direction allows the elasticized ear flap to differentially stretch and conform to the wearer's waist during use while providing a secure anchor about the hip of the wearer so as to promote sustained fit and reduce leakage at the waist and legs. Such a configuration may allow more "expansion" in the hip area to accommodate changes in the wearer's body size as the wearer moves and changes positions (standing, sitting, lying). In an alternative embodiment, a degree of reduced lateral extensibility in the portion of the elasticized ear flap adjacent to the end edge 64 of the disposable training pants 20 requires more of the total extension to be assumed by the elasticized waistband 34 thereby resulting in more localized stretching of the elasticized waistband 34 and a more compliant abdominal fit.

The differential extensibility can be achieved in a number of different ways. The elasticized ear flaps 30 can have multiple combined elastomeric materials, multiple configurations for the elastomeric materials, or the extension properties of the elastomeric or other material or materials making up the elasticized ear flap may

be nonuniform. For example, differential extensibility can be achieved in selected adjacent portions of the elasticized ear flap by using elastomeric materials having varying extension or contractive forces, modulus, or other inherent properties such that more or less (varying) lateral extensibility is achieved in one portion of the elasticized ear flap than the adjacent portion. The elastomeric materials may also have varying lengths, sizes, and shapes that provide differential extensibility. Other ways of varying the properties of materials that form the elasticized ear flaps as are known in the art may also be used.

A particularly preferred method and apparatus for imparting a varying degree of extensibility to a "zero strain" stretch laminate is to pass the "zero strain" stretch laminate through at least one set of meshing corrugated rolls, at least one of the corrugated rolls having corrugations of nonuniform profile along its point or points of contact with the "zero strain" stretch laminate web. As a result, the portions of the laminate web passing between the set of rolls are nonuniformly stretched. This, in turn, produces a "zero strain" stretch laminate which is nonuniformly elasticized in a direction substantially perpendicular to the nonuniformly profiled corrugations.

The chassis 14 of the disposable training pants 20 preferably further comprises elasticized leg cuffs 32 for providing improved containment of liquids and other body exudates. Each elasticized leg cuff 32 may comprise several different embodiments for reducing the leakage of body exudates in the leg regions. (The leg cuff can be and is sometimes also referred to as leg bands, side flaps, barrier cuffs, or elastic cuffs.) U.S. Pat. No. 3,860,003 issued to Buell on Jan. 14, 1975, describes a disposable diaper which provides a contractible leg opening having a side flap and one or more elastic members to provide an elasticized leg cuff (gasketing cuff). U.S. Pat. No. 4,909,803 issued to Aziz and Blaney on Mar. 20, 1990, describes a disposable diaper having "stand-up" elasticized flaps (barrier cuffs) to improve the containment of the leg regions. U.S. Pat. No. 4,695,278 issued to Lawson on Sept. 22, 1987, describes a disposable diaper having dual cuffs including a gasketing cuff and a barrier cuff. U.S. Pat. No. 4,704,115 issued to Buell on Nov. 3, 1987, discloses a disposable diaper or incontinent garment having side-edge-leakage-guard gutters configured to contain free liquids within the garment. Each of these patents are incorporated herein by reference. While each elasticized leg cuff 32 may be configured so as to be similar to any of the leg bands, side flaps, barrier cuffs, or elastic cuffs described above, it is preferred that each elasticized leg cuff 32 comprise at least a side flap 104 and one or more elastic strands 105.

The chassis 14 of the disposable training pants 20 further preferably comprises an elasticized waistband 34 disposed adjacent the end edge 64 of the disposable training pants 20 in at least the rear portion 58, and more preferably has an elasticized waistband 34 disposed in both the front portion 56 and the rear portion 58. The waistband of the disposable training pants 20 is that portion which is intended to be placed adjacent the wearer's waist. The elasticized waistband 34 provides a member that maintains a defined area coverage, contacts the wearer's waist, and is elastically extensible in at least the lateral direction so as to dynamically fit against the waist of the wearer and to dynamically conform to the waist of the wearer so as to provide improved fit. Thus, the waistband is generally that portion of the disposable training pants 20 extending from the end edge 64 of the disposable training pants 20 to at least the waist edge 83 of the absorbent core 28. While the elasticized waistband 34 can comprise a separate element affixed to the chassis 14 of the disposable training pants 20, the waistband is preferably an extension of other elements of the disposable training pants 20 such as the inner layer 46, the outer layer 48, or any combination of these elements and an elastomeric material joined thereto. Alternatively, the topsheet 24 and the backsheet 26 of the absorbent assembly 22, may extend beyond the edges of the absorbent core 28 and have an elastomeric material joined thereto to form an elasticized waistband. Disposable training-pants are often constructed so as to have two elasticized waistbands; one positioned in the front portion 56 and one positioned in the rear portion 58. The disposable training pants 20 at least has an elasticized waistband 34 disposed in at least the central region 68 of the rear portion 58. Preferably, as shown in FIG. 2, another elasticized waistband is disposed in the front portion 56. Preferably both elasticized waistbands 34 are disposed between the elasticized ear flaps 30.

The elasticized waistband 34 may be constructed in a number of different configurations including those described herein with regard to the elasticized side panels. In a preferred embodiment of the present invention shown in FIG. 2, the elasticized waistband 34 comprises an elastic waistband member 76 interposed between the inner cover 46 and the outer cover 48 and operatively associated with either or both the inner cover 46 and the outer cover 48 to gather the front portion 56 and rear portion 58 of the disposable training pants 20. An example of such an elasticized waistband for use herein is the elasticized waistband disclosed in U.S. Patent 4,515,595 issued to Kievit and Osterhage on May 7, 1985, and which patent is incorporated herein by reference.

Any suitable elastomeric material as known in the art may be used as the elastic waistband member 76 of the present invention. Examples of suitable elastomeric materials include elastomeric films, elastomeric foams such as polyurethane foams or crosslinked natural rubber foams; formed elastic scrim; elastomeric films such as heat shrinkable elastic materials; elastomeric film laminates such as a laminate of a heat-shrinkable elastomeric film and a resilient member; elastomeric stretch laminates such as "zero strain" stretch laminates as described hereinafter or mechanically stretched pretensioned stretch laminates; and elastic strands made from rubber, LYCRA, or other materials. In a preferred embodiment, the elastic waistband member 76 comprises a heat shrinkable elastomeric film.

In an alternative embodiment, the elasticized waistbands 34 and the elasticized ear flaps 30 can be formed by securing a single piece of elastomeric material to the disposable garment 20 in both the ear flaps 72 and the central region 68 of the rear portion 58 and securing a single piece of elastomeric material to the disposable garment 20 in both the ear flaps 72 and central region 68 of the front portion 56. Thus, the elasticized waistband 34 and the elasticized ear flaps 30 can be formed from the same piece of material to form a unitary structure.

In a preferred embodiment of the chassis as shown in FIG. 2, the longitudinal side region 88 is that portion of the chassis 14 that extends laterally outwardly from the ear flap 72 to the longitudinal edge 62 of the chassis 14. The longitudinal side region 88 generally extends longitudinally from the end edge 64 of the chassis 14 to the portion of the longitudinal edge 62 of the chassis 14 that forms the leg opening (this segment of the longitudinal edge 62 being designated as leg edge 106). While the longitudinal side region 88 can comprise a separate element affixed to the ear flap 72 of the chassis 14, the longitudinal side region is preferably an extension of other elements of the chassis 14 such as the inner layer 46, the outer layer 48, the topsheet 24 or the backsheet 26 or any combination of these elements. In a preferred embodiment of the present invention each longitudinal side region 88 is formed by portions of the inner layer 46 and outer layer 48 that extend beyond the ear flap 72.

Referring again to FIG. 1, seams 10 are preferably formed by bonding together the longitudinal side regions 88 of the front portion 56 with the longitudinal side regions 88 of the rear portion 58. The seam 10 can be formed in a number of different ways. For example, the seam 10 can be formed by bonding together portions of outwardly extending longitudinal side regions 88 to form an outwardly extending fin seam, bonding together portions of inwardly extending longitudinal side

regions 88 to form an inwardly extending fin seam, the longitudinal side regions 88 may be overlapped and bonded together, or the longitudinal side regions 88 may be bonded together using any other seam configurations that are well known in the art. The bonding can be by any suitable means well known in the art appropriate for the specific material employed in the longitudinal side region 88 of the chassis 14; thus sonic sealing, heat sealing, adhesive bonding, sewing, and the like may be appropriate techniques. Examples of such seaming techniques are disclosed in U.S. Patent 4,355,425 issued to Jones, et al. on October 26, 1982; U.S. Patent 4,619,649 issued to Roberts on October 28, 1986; and U.S. Patent 4,909,804 issued to Douglas, Sr. on March 20, 1990.

In a preferred embodiment of the present invention, the disposable garment is formed by folding the chassis in the crotch portion 57 so that the longitudinal side regions 88 of the front portion 56 are substantially superposed with the longitudinal side regions 88 of the rear portion 58 forming two seaming areas. Preferably, the layers of material making-up the seaming area, have similar melting points. More preferably, each layer of the seaming area is made of the same material.

The seam 10 is preferably formed by treating the seaming area 40 with mechanical energy sufficient to cut a portion of the seaming area 40 while simultaneously fusing a narrow marginal area adjacent to the cut. The fused marginal area is a relatively small region and provides a finished flangeless seam. As used herein the term "flangeless seam" refers to a seam which extends from the disposable training pants 20 about 1/16" or less. Preferably the flangeless seam will extend from the garment about 1/32" or less. In a preferred embodiment, the flangeless seam is substantially a splice between the front portion 56 and rear portion 58 of the chassis 14. As used herein, the term "splice" refers to the act or result of joining end to end two pieces of sheet material to form a continuous length such that the thickness of the joint is no greater or not much greater than the thickness of the sheet materials.

Although there is considerable evidence to indicate that all energy is mechanical energy, there are forms of energy which may be considered "non-mechanical" energy, such as thermal energy, electrical energy, and chemical energy. However, as used herein, the term "mechanical energy" will be used to refer to mechanical energy (e.g., the energy employed in ultrasonic bonding or autogeneous pressure bonding) as well as to thermal energy (e.g., the energy employed in heat sealing). Preferably, ultrasonic energy is used to simultaneously cut and bond the seaming area 40 to produce the seams 10 of the present invention.

Preferably, the mechanical energy is input to the seaming area 40 using an ultrasonic apparatus. An ultrasonic apparatus will generally comprise an ultrasonic converter unit which receives high frequency electrical energy from an electrical energy source via an electrical conductor. The converter unit contains piezoelectric transducer material for providing, in response to high frequency input power, mechanical vibrations to a horn which will oscillate back and forth relative to a support surface which acts as an anvil.

FIG. 6 is a side elevational schematic view of a preferred ultrasonic apparatus, shown generally at 600. The ultrasonic horn 650 having a working tip 652 is coupled to an ultrasonic converter unit 645 which receives high frequency electrical energy from an electrical energy source (not shown). The working tip 652 of the horn 650 is opposed by an anvil 654 mounted on an axially rotatable roll 656. The folded chassis 614 of the disposable garment is shown passing between the working tip 652 and anvil 654. The ultrasonic horn 650 is operated at an ultrasonic frequency preferably in the range of about 20 kHz to about 40 kHz, but any other frequency in the normal operating range between 16 and 100 kHz will be suitable.

FIG. 6A shows a cross-sectional view of the seaming apparatus 600 of FIG. 6. The seaming area 40 of the folded chassis 614 is shown passing between the anvil 654 and the working tip 652, as the horn 650 oscillates back and forth, i.e. toward and away from the anvil 654. The ultrasonic energy of the seaming apparatus 600 causes the layers of polymeric material of the seaming area 40 to soften and flow, thinning or cutting the seaming area 40 in a first area 658 while fusing the seaming area 40 in the thin marginal areas adjacent the first area 658 forming a fused mass 660. While the portion 664 of the seaming area 40 which has been cut away from the disposable training pants 20, will be disposed as selvage, the fused mass 660 of the portion 662 of the seaming area 40 which is still part of the disposable training pants 20 will provide to the disposable training pants 20 a finished seam 10 which is substantially a splice between the front portion 56 and rear portion 58.

The anvil 654 of the preferred seaming apparatus 600 shown in FIG. 6A, has a contacting edge 670. The width of the contacting edge is designated by the letter W' and is preferably about 0.030 inches. The anvil 654 also has beveled edges 680 which form an angle with the contacting edge 670. The angle of the beveled edges is designated by the letter A and is preferably about 15o. The width of the anvil 654 is designated by the letter W and is preferably about 0.100 inches. The height of the anvil is designated by the letter H and is preferably about 0.100 inches.

Without being bound by any particular theory, it is believed that the ultrasonic horn 650 creates, by virtue of its high speed low amplitude oscillations, localized frictional losses, the heat of which causes the polymeric fibers of the seaming area 40 to soften and to fuse. This welding or fusing action is very rapid and occurs within such a well defined zone as to leave the surrounding material substantially undisturbed.

Examples of methods and apparatus for treating materials with ultrasonic energy are disclosed in U.S. Patent 3,657,033 issued to Sager on April 18, 1972 entitled "Method and Apparatus for Continuous Cutting and Joining of Thermoplastic Sheet Material"; U.S. Patent 4,400,227 issued to Riemersma on August 23, 1983; U.S. Patent 4,430,148 issued to Schaefer on February 7, 1984; U.S. Patent 4,560,427 issued to Flood on December 24, 1985, and U.S. Patent 4,693,771 issued to Payet, et al. on September 15, 1987; all of which references are incorporated herein by reference. U.S. Patent 3,457,132 issued to Tuma, et al. on July 22, 1969, discloses a method and apparatus for severing and sealing webs of heat sealable material using thermal energy. This reference is also incorporated herein by reference.

When making the small flangeless seams of the present invention, it is preferable that the layers of polymeric material of the seaming area 40, have similar melting points. It is more preferable that the seaming area 40 be made of layers of the same polymeric material.

The strength of the flangeless seams of the present invention can be increased by using polymeric material having a higher basis weight. If the material of the longitudinal side regions 88 is very thin, the seaming area 40 may not contain sufficient material to form an adequate seam, e.g. the seam may not be strong enough for the garment. In this situation, additional layers of material may be introduced to the longitudinal side region 88 such that the seaming area 40 will contain sufficient material to form an adequate seam.

As shown in FIG. 2, the absorbent assembly 22 of the disposable training pants 20 preferably comprises an absorbent core 28 and an outer covering layer comprising a topsheet 24 and a backsheet 26. The absorbent assembly 22 is preferably positioned adjacent the inner layer 46 and is preferably joined thereto by attachment means (not shown) such as those well known in the art. Suitable attachment means are described hereinbelow with respect to joining the backsheet 26 to the absorbent core 28.

The absorbent core 28 may be any absorbent means which is generally compressible, conformable, non-irritating to the wearer's skin, and capable of absorbing and retaining liquids such as urine and other certain body exudates. As shown in FIG. 2, the absorbent core 28 has a garment surface 100, a body surface 101, side edges 82 and end edges 83.

The absorbent core 28 may be manufactured in a wide variety of sizes and shapes (e.g., rectangular, hourglass, "T"-shaped, asymmetric, etc.) and from a wide variety of liquid-absorbent materials commonly used in disposable diapers and other absorbent articles such as comminuted wood pulp which is generally referred to as airfelt. Examples of other suitable absorbent materials include creped cellulose wadding, meltblown polymers including coform, cross-linked cellulosic fibers, tissue including tissue wraps, absorbent foams, absorbent sponges, superabsorbent polymers, absorbent gelling materials, or any equivalent material or combinations of materials. The configuration and construction of the absorbent core may also be varied (e.g., the absorbent core may have varying caliper zones, a hydrophilic gradient, a superabsorbent gradient, or lower average density and lower average basis weight acquisition zones; or may comprise one or more layers or structures). The total absorbent capacity of the absorbent core 28 should, however, be compatible with the design loading and the intended use of the disposable training pants 20. Further, the size and absorbent capacity of the absorbent core 28 may be varied to accommodate wearers ranging from infants through adults.

A preferred embodiment of the absorbent assembly 22 has a symmetric, modified hour-glass shape absorbent core 28. While a preferred embodiment of the absorbent assembly 22 has a modified hourglass-shaped absorbent core 28, it should be understood that the size, shape, configuration and total absorbent capacity of the absorbent core 28 may be varied to accommodate wearers ranging from infants to adults. Therefore, the dimensions, shape and configuration of the absorbent core may be varied (e.g., the absorbent core may have a varying caliper, or a hydrophilic radiant, or may or may not contain absorbent gelling materials). An exemplary absorbent structure for use as the absorbent core 28 of the present invention that has achieved wide acceptance and commercial success is described in U.S. Patent 4,610,678 entitled "High-Density Absorbent Structures" issued to Weisman and Goldman on September 9, 1986. U.S. Patent 4,673,402 entitled "Absorbent Articles With Dual-Layered Cores" issued to Weisman, Houghton, and Gellert on June 16, 1987; U.S. Patent 4,834,735 entitled "High Density Absorbent Members Having

Lower Density and Lower Basis Weight Acquisition Zones" issued to Alemany and Berg on May 30, 1989; and U.S. Patent 4,888,231 entitled "Absorbent Core Having A Dusting Layer" issued to Angstadt on December 19, 1989; also describe absorbent structures that are useful in the present invention. Each of these references are incorporated herein by reference. The absorbent core 28 is preferably a batt of airfelt and particles of absorbent gelling material, about 13 centimeters wide (lateral dimension), about 37 centimeters long (longitudinal dimension) and approximately 8 centimeters across the narrowest part of the crotch portion 57. Preferably, the portion of the absorbent core that will be generally located in the front portion 56 and crotch portion 57 will have a higher basis weight than the portion of the absorbent core that will be generally located in the rear portion 58. More preferably, the portion of the absorbent core that will be generally located in the front portion 56 and crotch portion 57 will have a basis weight three times the basis weight of the portion of the absorbent core that will be generally located in the rear portion 58. In a preferred embodiment of the absorbent core 28, about 25.4 centimeters of the absorbent core's length will be generally located in the front portion 56 and crotch portion 57 and will have a basis weight of about 0.69 grams per square inch, and 11.4 centimeters of the absorbent core's length will be generally located in the rear portion 58 and will have a basis weight of about 0.23 grams per square inch.

The backsheet 26 is positioned adjacent the garment surface 100 of the absorbent core 28 and is preferably joined thereto by attachment means (not shown) such as those well known in the art. For example, the backsheet 26 may be secured to the absorbent core 28 by a uniform continuous layer of adhesive, a patterned layer of adhesive, or an array of separate lines, spirals, or spots of adhesive. Adhesives which have been found to be satisfactory are manufactured by Century Adhesives, Inc. of Columbus, Ohio and marketed as Century 5227; and by H. B. Fuller Company of St. Paul, Minnesota and marketed as HL-1258. The attachment means will preferably comprise an open pattern network of filaments of adhesive as is disclosed in U.S. Patent 4,573,986 entitled "Disposable Waste-Containment Garment", which issued to Minetola and Tucker on March 4, 1986, and which is incorporated herein by reference. An exemplary attachment means of an open pattern network of filaments comprises several lines of adhesive filaments swirled into a spiral pattern such as is illustrated by the apparatus and methods shown in U.S. Patent 3,911,173 issued to Sprague, Jr. on October 7, 1975; U.S. Patent 4,785,996 issued to Ziecker, et al. on November 22, 1978; and U.S. Patent 4,842,666 issued to Werenicz on June

27, 1989. Each of these patents are incorporated herein by reference. Alternatively, the attachment means may comprise heat bonds, pressure bonds, ultrasonic bonds, dynamic mechanical bonds, or any other suitable attachment means or combinations of these attachment means as are known in the art.

The backsheet 26 is impervious to liquids (e.g., urine) and is preferably manufactured from a thin plastic film, although other flexible liquid impervious materials may also be used. As used herein, the term "flexible" refers to materials which are compliant and will readily conform to the general shape and contours of the human body. The backsheet 26 prevents the exudates absorbed and contained in the absorbent core 28 from wetting articles which contact the disposable training pants 20 such as bedsheets and undergarments. The backsheet 26 may thus comprise a woven or nonwoven material, polymeric films such as thermoplastic films of polyethylene or polypropylene, or composite materials such as a film-coated nonwoven material. Preferably, the backsheet is a film having a thickness of from about 0.012 mm (0.5 mil) to about 0.051 mm (2.0 mils).

The size of the backsheet 26 is dictated by the size of the absorbent core 28 and the exact disposable garment design selected. In a preferred embodiment, the backsheet 26 will wrap around at least the absorbent core and possibly over the edge portions of the topsheet 24 in at least the crotch portion 57, so that the elasticized leg cuff 32 will be free from any backsheet material, and, thus, are not inhibited by the backsheet material. Alternatively, the topsheet 24 may wrap around the core and under the edge portions of the backsheet 26 in at least the crotch portion 57, or the topsheet 24 and backsheet 26 may be "side-notched" in the crotch portion 57 so that the elasticized leg cuffs 32 are not inhibited by the backsheet material.

The topsheet 24 is positioned adjacent the body surface 101 of the absorbent core 28 and is preferably joined thereto and to the backsheet 26 by attachment means (not shown) such as those well known in the art. Suitable attachment means are described with respect to joining the backsheet 26 to the absorbent core 28. In a preferred embodiment of the present invention, the topsheet 24 and the backsheet 26 are joined directly to each other in the areas extending beyond the absorbent core 28 and are indirectly joined together by directly joining them to the absorbent core 28 by the attachment means (not shown).

The topsheet 24 is compliant, soft feeling, and non-irritating to the wearer's skin. Further, the topsheet 24 is liquid pervious permitting liquids (e.g., urine) to readily penetrate through its thickness. A suitable topsheet may be manufactured

from a wide range of materials, such as porous foams; reticulated foams; apertured plastic films; or woven or nonwoven webs of natural fibers (e.g., wood or cotton fibers), synthetic fibers (e.g., polyester or polypropylene fibers), or a combination of natural and synthetic fibers. Preferably, the topsheet 24 is made of hydrophilic material comprising about 20% to 30% rayon so as to feel wet and signal a discharge of urine to a toilet training child.

There are a number of manufacturing techniques which may be used to manufacture the topsheet 24. For example, the topsheet 24 may be a nonwoven web of fibers. When the topsheet comprises a nonwoven web, the web may be spunbonded, carded, wet-laid, meltblown, hydroentangled, combinations of the above, or the like. A preferred topsheet is carded and thermally bonded by means well known to those skilled in the fabrics art. A suitable topsheet is manufactured by Fiberweb North America and available as 80/20 polypropylene/rayon carded thermally bonded nonwoven.

While in a preferred embodiment of the present invention, the topsheet 24 does not form a part of the chassis 14, but is separately manufactured and inserted as part of the absorbent assembly 22 onto the chassis, the chassis 14 may be made without an inner layer 46, and the topsheet 24 of the absorbent assembly 22 may extend beyond the edges of the backsheet 26 in at least the front and rear portions 56, 58 of the chassis 14 such that the topsheet 24 will be disposed over the elastic ear flap members 90 and form the inner surface of the chassis 14. In this embodiment, at least a portion of the topsheet 24 is subjected to mechanical stretching in order to provide a "zero strain" stretch laminate that forms the elasticized ear flaps 30. Thus, the topsheet 24 of this embodiment should be elongatable, preferably drawable, but not necessarily elastomeric, so that the topsheet 24 will, upon mechanical stretching, be at least to a degree permanently elongated such that it will not fully return to its original configuration. However, this embodiment is not preferred because urine may "wick" beyond the central region 68 of the chassis 14 and fail to be contained within the absorbent assembly 22.

While particular embodiments of the present invention have been illustrated and described, it would be obvious to those skilled in the art that various other changes and modifications can be made without departing from the spirit and scope of the invention. It is therefore intended to cover in the appended claims all such changes and modifications that are within the scope of this invention.

WHAT IS CLAIMED IS:

1. A fluid impervious zero strain stretch laminate web having an original unstretched length, said laminate web characterized by: a fluid impervious elastic member substantially continuously secured to at least one substantially untensioned nonwoven member which is elongatable, but which exhibits less elastic recovery than said elastic member, said nonwoven member and said elastic member stretch but do not rupture when subjected to a mechanical stretching operation which stretches said laminate web to at least 50% of its original unstretched length.

2. The laminate web of Claim 1, wherein said fluid impervious elastic member is substantially continuously secured to two substantially untensioned nonwoven members which are elongatable, but which exhibits less elastic recovery than said elastic member.

3. The laminate web of either Claim 1 or Claim 2, wherein said nonwoven member and said elastic member stretch but do not rupture when subjected to a mechanical stretching operation which stretches said laminate web to at least 100% of its original unstretched length.

4. The laminate web of any one of the preceding claims, wherein said nonwoven member and said elastic member stretch but do not rupture when subjected to a mechanical stretching operation which stretches said laminate web to at least 200% of its original unstretched length.

5. The laminate web of any one of the preceding claims, wherein said laminate web forms a portion of a disposable diaper.

6. The laminate web of Claim 5, wherein said laminate web forms an ear flap on said disposable diaper.

7. The laminate web of any one of the preceding claims, wherein said laminate web forms a portion of a training pant.

8. The laminate web of Claim 7, wherein said laminate web forms an ear flap on said training pant.

9. The laminate web of Claim 7, wherein said laminate web forms an elasticized waistband on said training pant.

10. The laminate web of any of the preceding claims, wherein said nonwoven member is a spunbonded web.

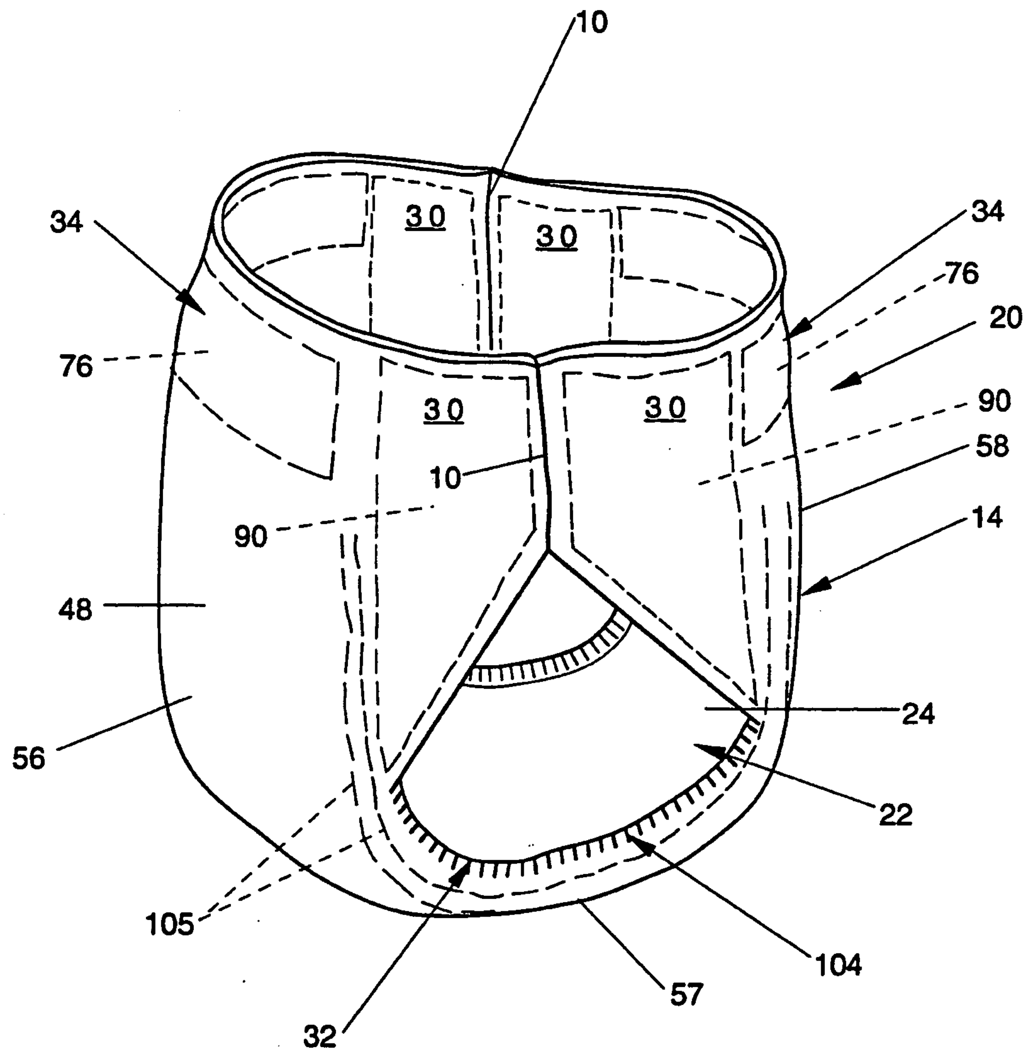

Fig. 1

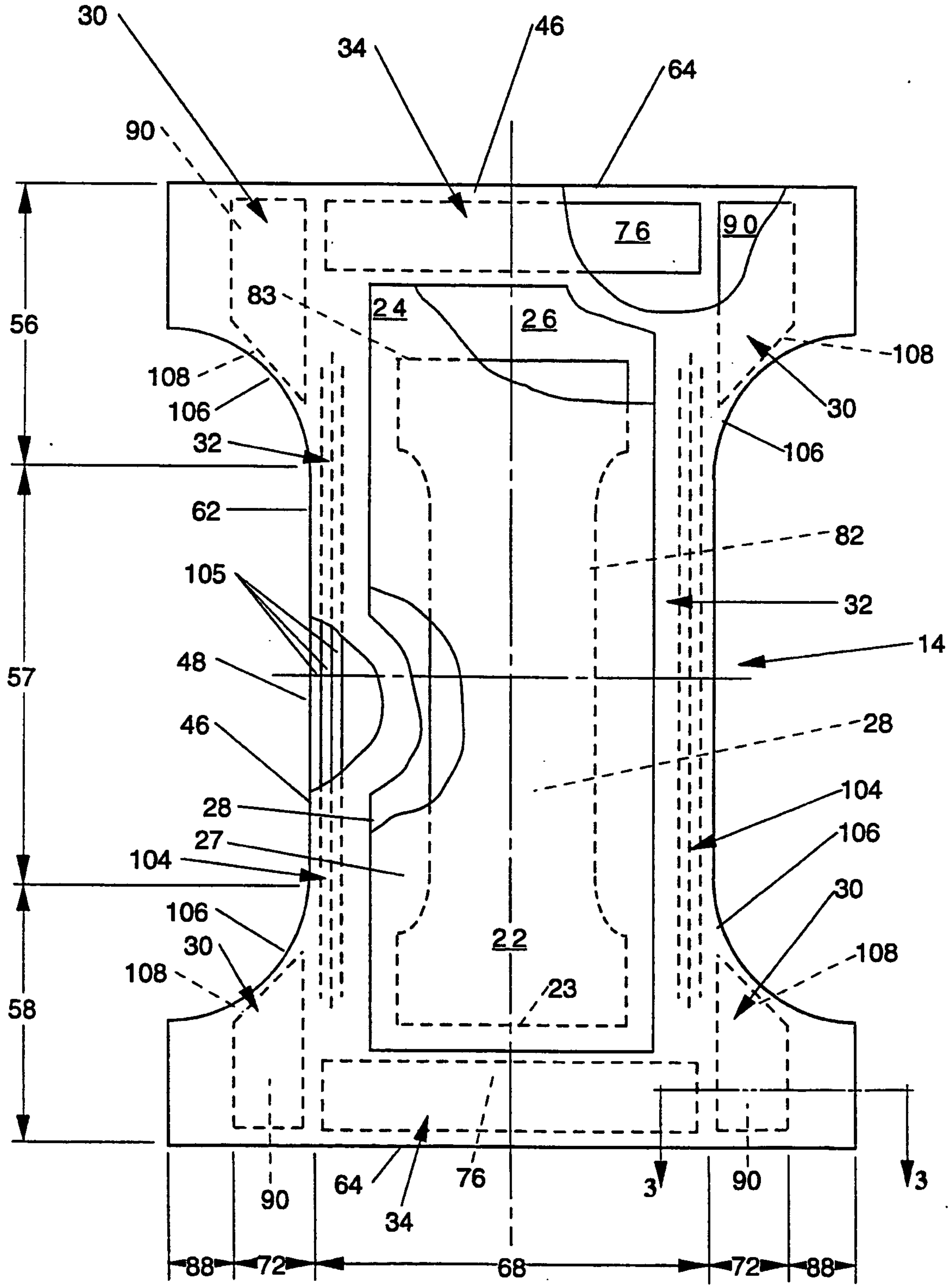
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Fig. 2

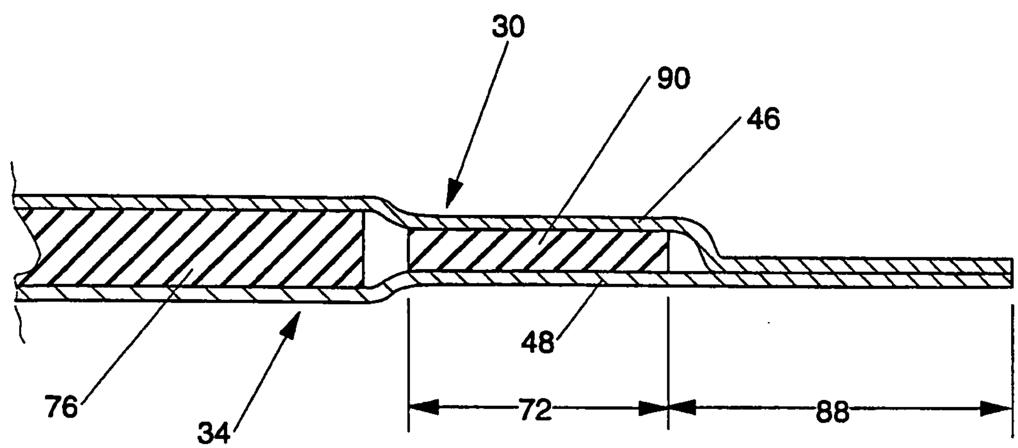


Fig. 3

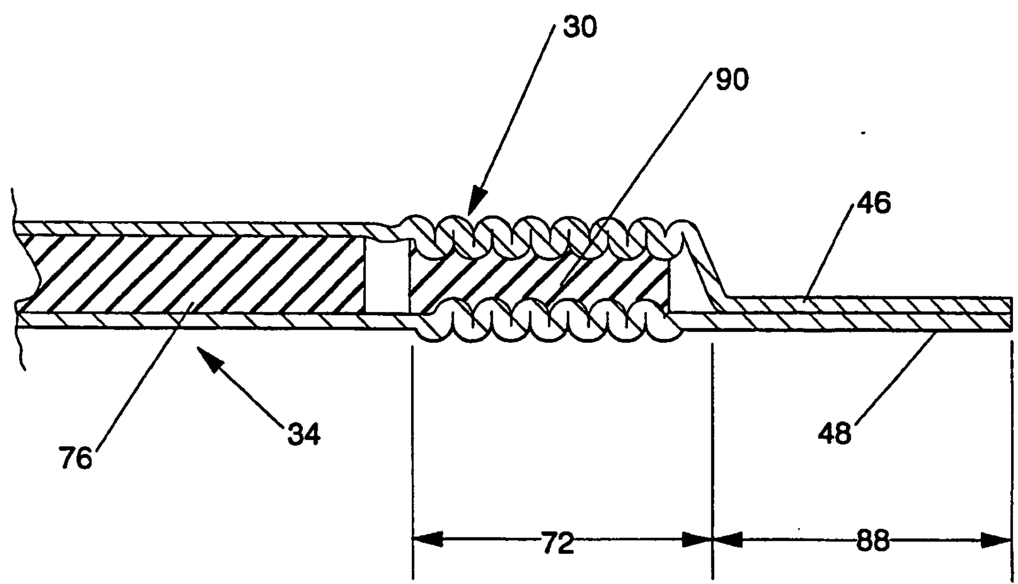
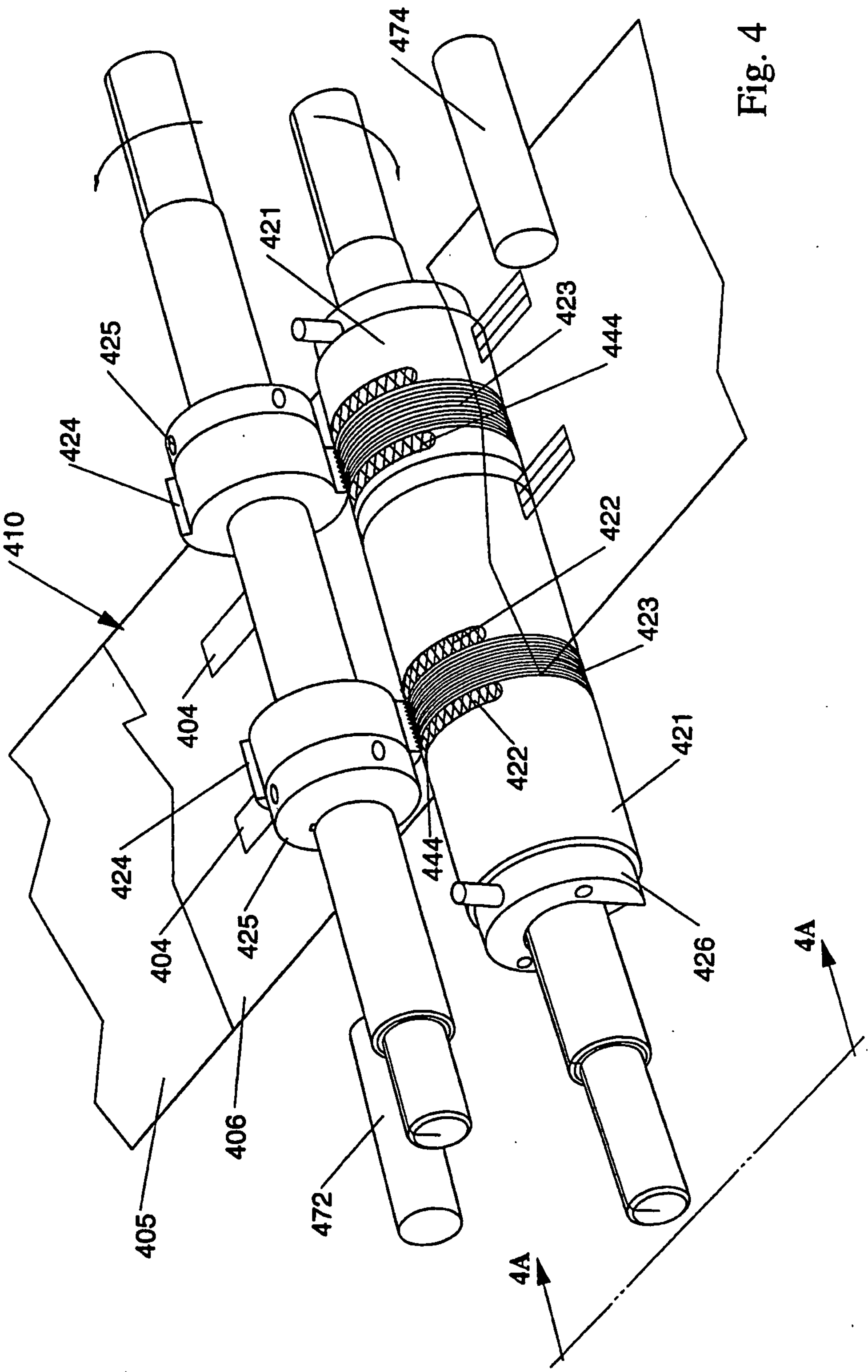


Fig. 3A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4A

Fig. 4

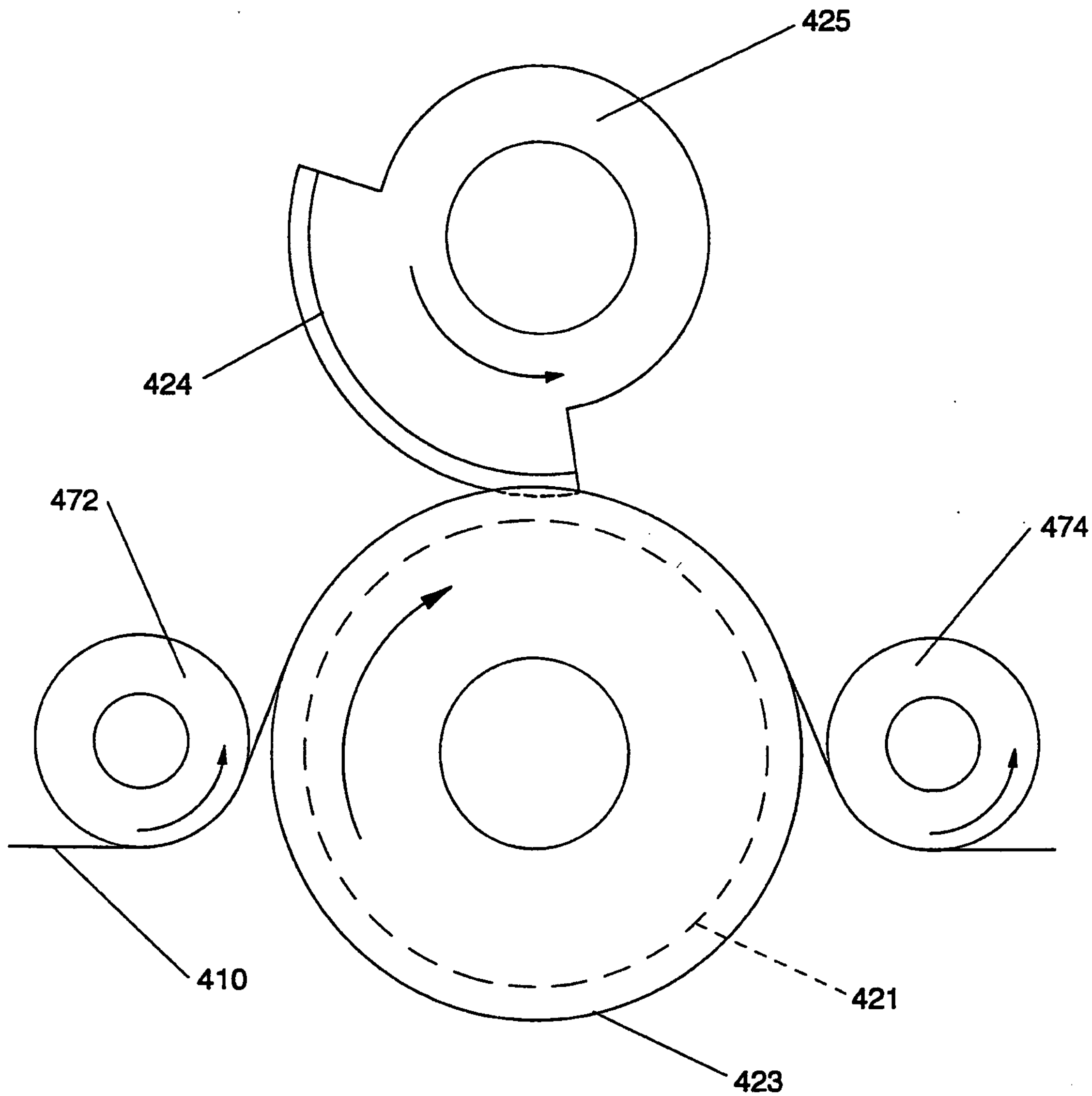

Fig. 4A

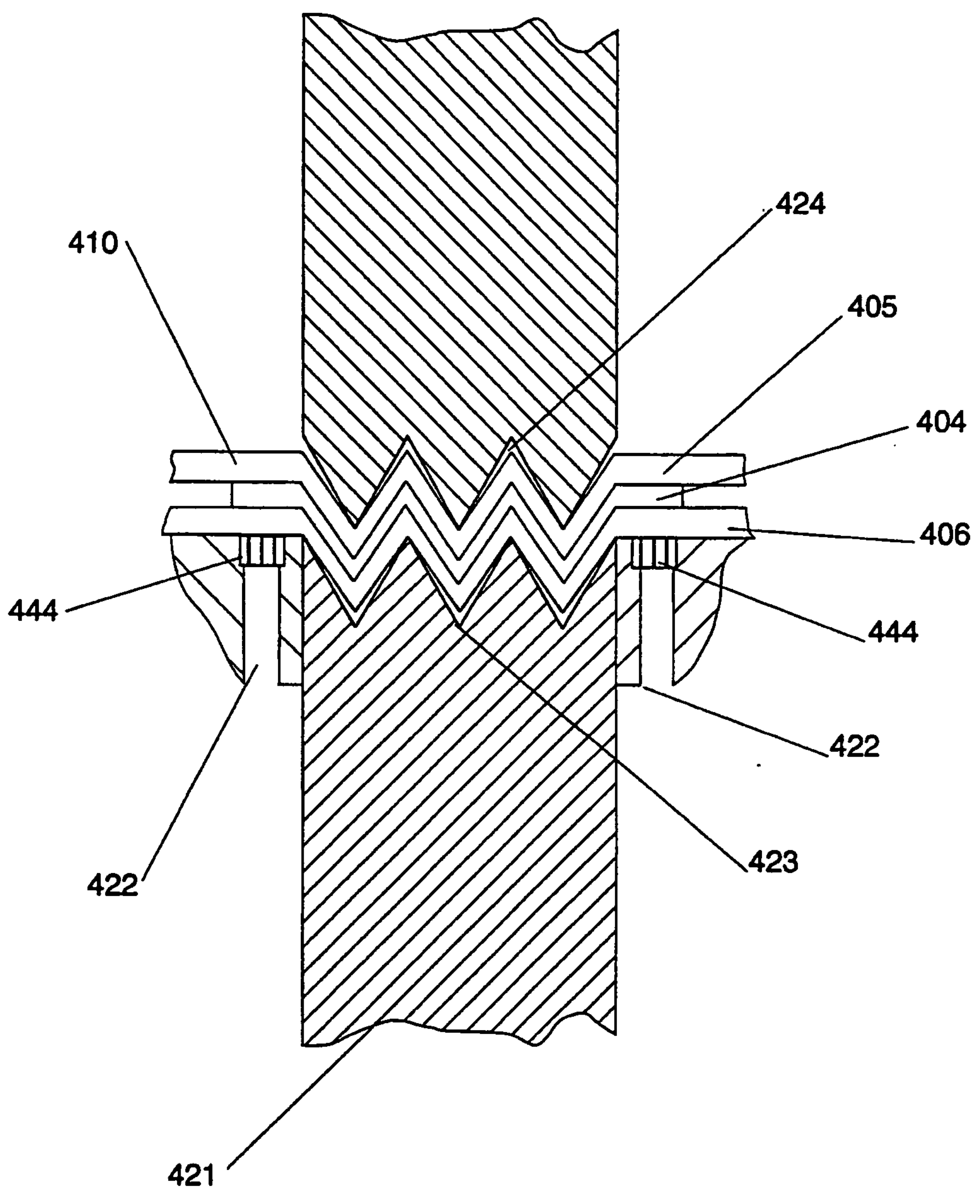

Fig. 4B

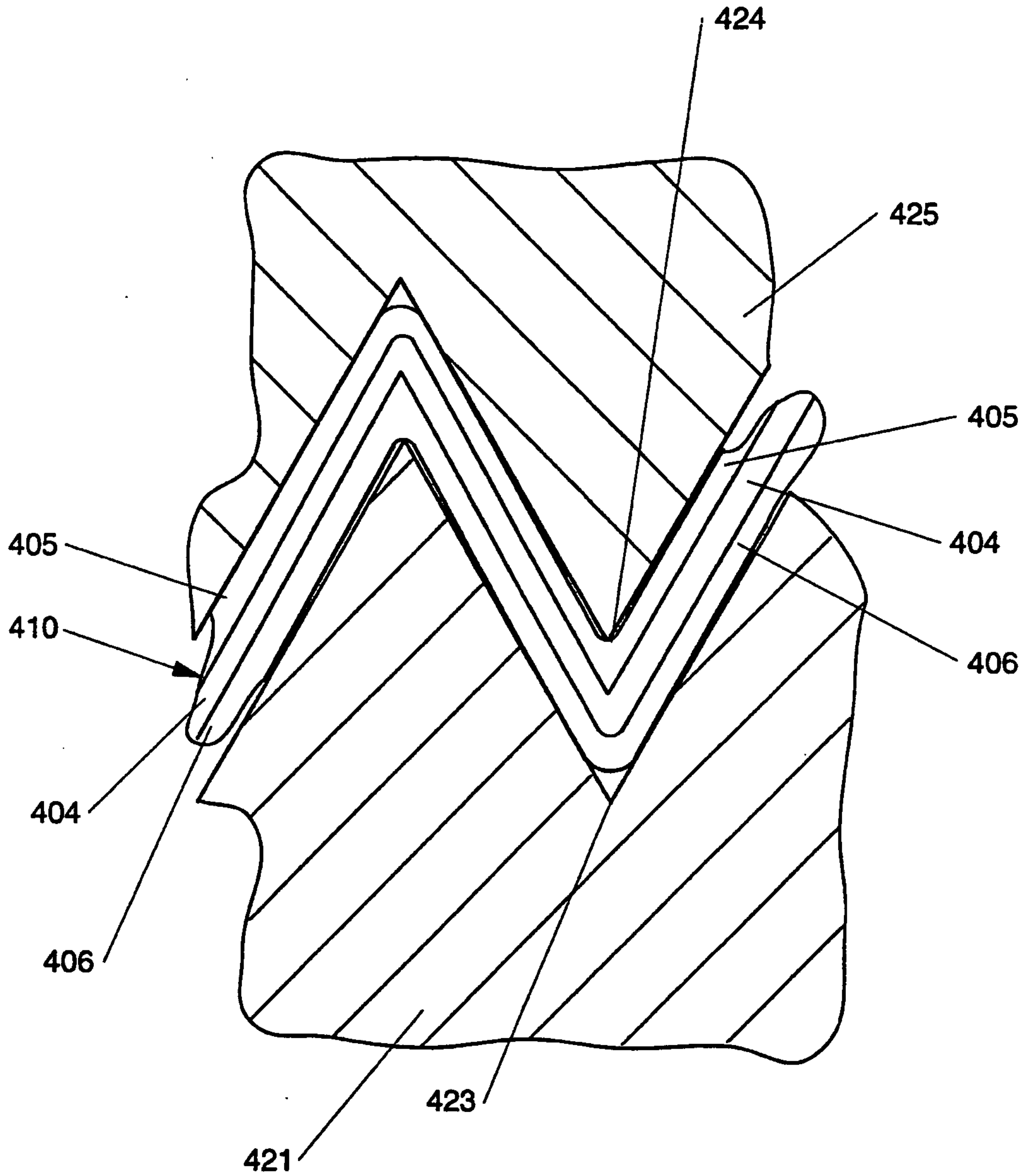

Fig. 4C

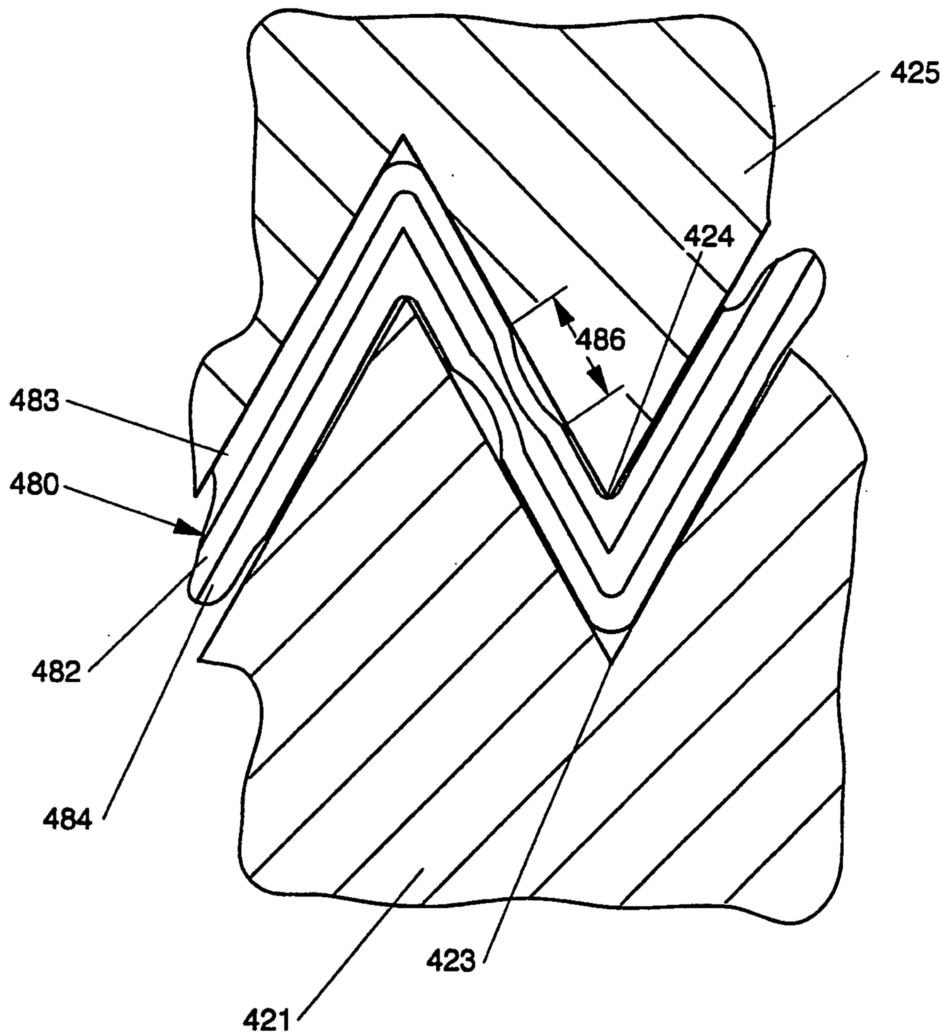

Fig. 4D

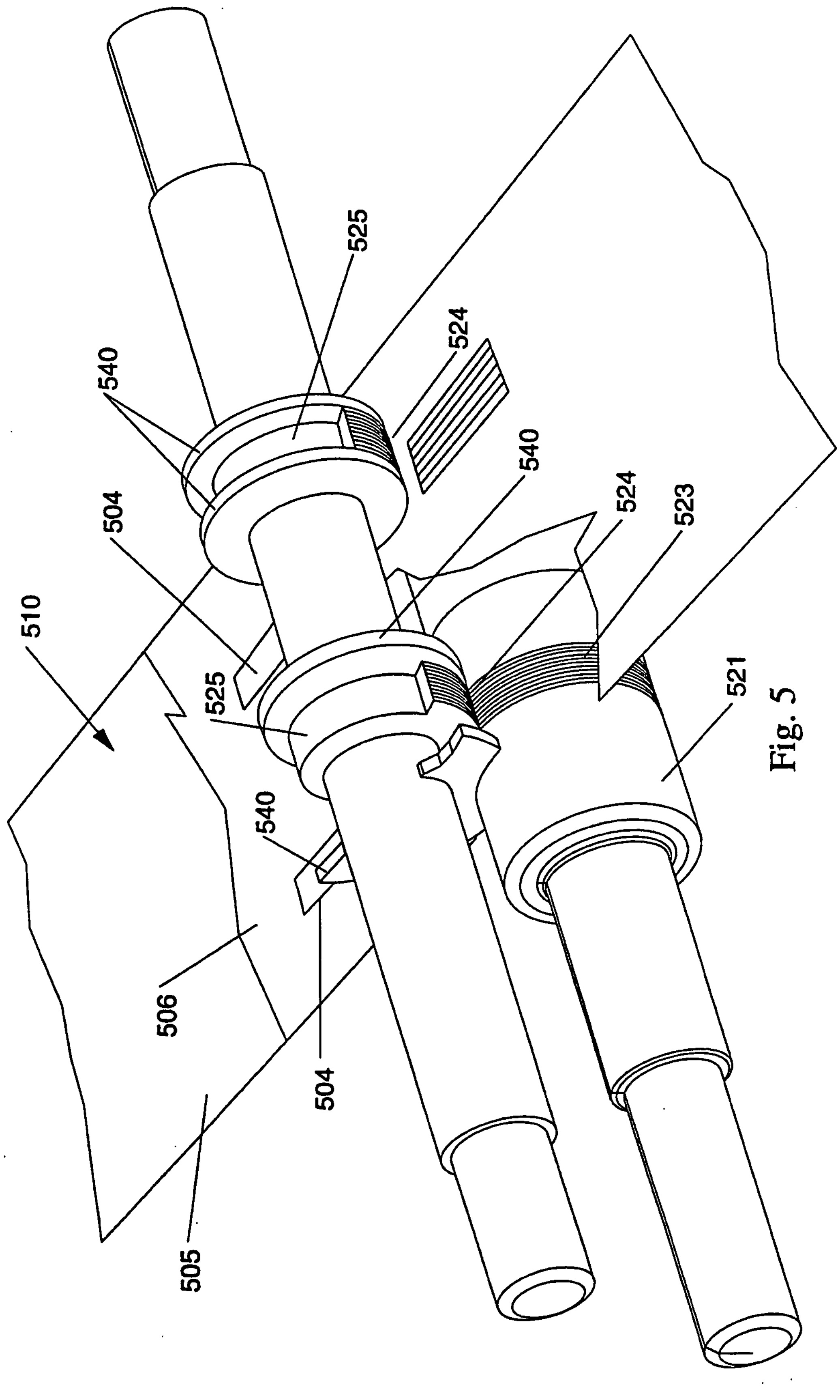

Fig. 5

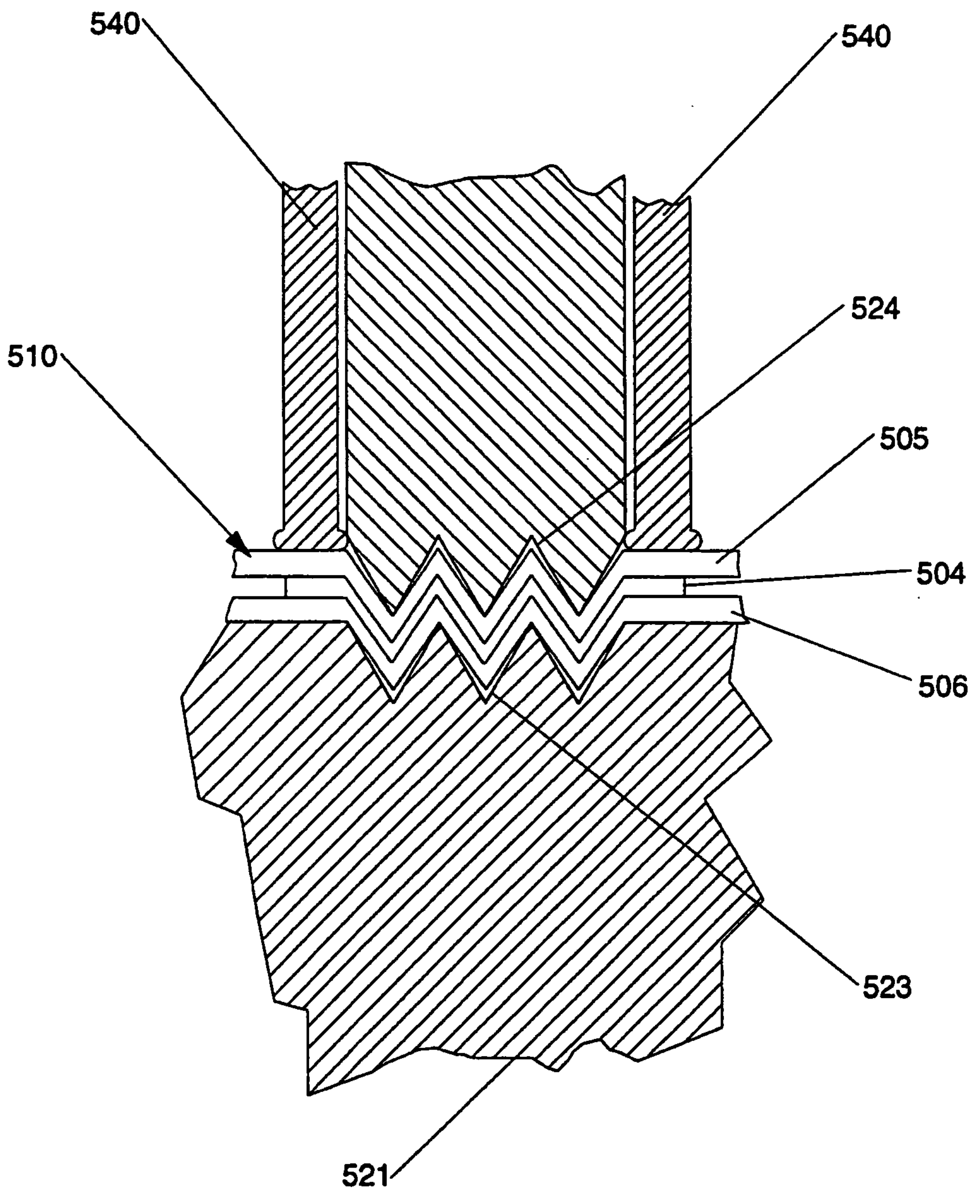

Fig. 5A

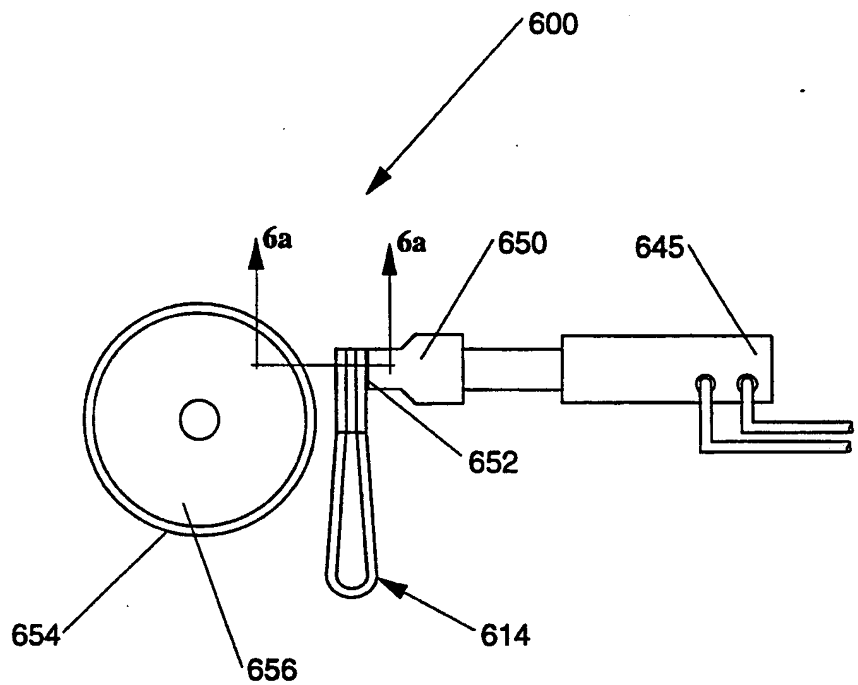

Fig. 6

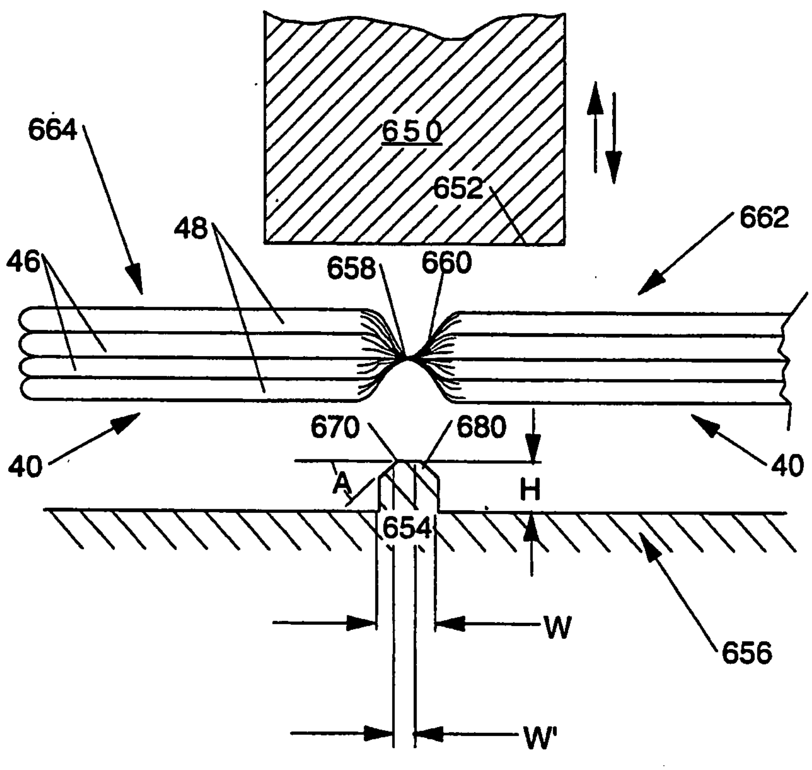

Fig. 6A

INTERNATIONAL SEARCH REPORT

Inte onal Application No
PCT/US 95/07652

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A61F13/15

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A61F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	US,A,5 342 858 (THE PROCTER & GAMBLE COMPANY) 30 August 1994 see column 26, line 22 - line 54 see column 27, line 12 - column 28, line 60 ---	1-9
A	WO,A,93 25171 (THE PROCTER & GAMBLE COMPANY) 23 December 1993 see page 14, paragraph 3 - page 18, paragraph 1 ---	1-9
A	US,A,5 167 897 (WEBER) 1 December 1992 cited in the application -----	

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

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Date of the actual completion of the international search	Date of mailing of the international search report
11 October 1995	13. 11. 95

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Douskas, K

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 95/07652

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		JP-T-	6505681	30-06-94
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		WO-A-	9215444	17-09-92